Radiation Mitigation Methods for Reprogrammable FPGA, Phase I

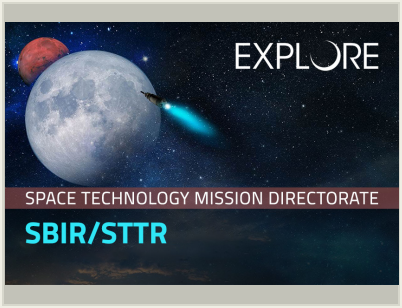
Completed Technology Project (2009 - 2009)

Project Introduction

One of the needs of NASA is the development of avionic systems and components that have the capability to operate in extreme radiation and temperature environments found in deep space, as well as the lunar and Martian surfaces. As a result, spacecraft electronics will be required to be hardened against radiation environment and temperature cycling. In fact, they should withstand a total ionizing dose (TID) of at least 100 krads (Si) and provide single-event latchup (SEL) immunity of at least 100 MeV cm2/mg. As part of these needs, NASA is interested in Field Programmable Gate Array (FPGA) technology with reliable reprogrammability and a degree of radiation hardness. We intend to answer NASA's need for FPGA technologies suitable for future exploration systems. In Phase I, we plan to focus on the integration of radiation hardening technologies involving both the structure of the FPGA and its sub-components, as well as use of an advanced foundry process and specialized circuits to mitigate radiation.

Anticipated Benefits

Potential NASA Commercial Applications: The same technology would also have applicability with the DoD. Example applications could include satellites, high attitude UAVs and aircraft, nuclear power plants (i.e. ship or submarine), or basically any electronic circuits requiring radiation hardness. This technology could also be applied in several DOE focused areas. The first and most obvious application would be the support electronics in a nuclear reactor. Another, potential area would be in support of electronics of a particle collider. There are also multiple places in industry where radiation hardened integrated circuits are needed. Some are not obvious as others. Certain medical equipment does require a degree of radiation tolerance. Apparently, some communication equipment and servers used in the banking industry have radiation mitigation requirements.



Radiation Mitigation Methods for Reprogrammable FPGA, Phase I

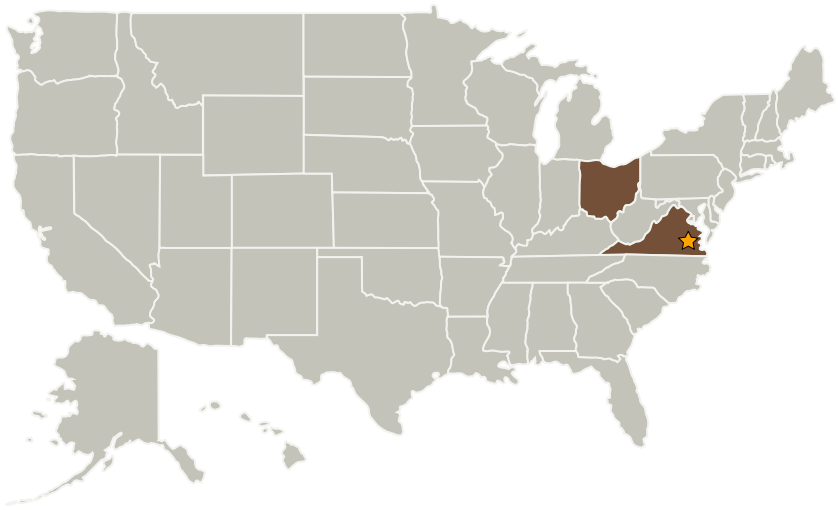
Table of Contents

Small Business Innovation Research/Small Business Tech Transfer

Radiation Mitigation Methods for Reprogrammable FPGA, Phase I

Completed Technology Project (2009 - 2009)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Langley Research Center(LaRC)	Lead Organization	NASA Center	Hampton, Virginia
RNET Technologies, Inc.	Supporting Organization	Industry	Dayton, Ohio

Primary U.S. Work Locations	
Ohio	Virginia

Project Transitions

January 2009: Project Start

July 2009: Closed out

Closeout Summary: Radiation Mitigation Methods for Reprogrammable FPGA, Phase I Project Image

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Langley Research Center (LaRC)

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

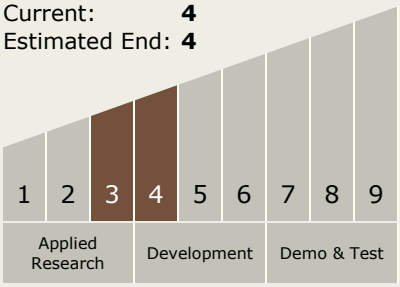
Carlos Torrez

Principal Investigator:

Vaidyanathan Nagarajan

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



Radiation Mitigation Methods for Reprogrammable FPGA, Phase I

Completed Technology Project (2009 - 2009)

Technology Areas

Primary:

- TX02 Flight Computing and Avionics
  - TX02.3 Avionics Tools, Models, and Analysis
    - TX02.3.2 Space Radiation Analysis and Modeling